



# Hydrogen Safety

What You need to Know!

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# Physical Properties are Important

- Molecular Weight 2.002 gm/mol
- State at NTP Gas
- Lower Heating value 120,020 kJ/kg
- Density at NTP 0.080 kg/m<sup>3</sup>
- MW ratio to air 0.07
- Normal Boiling Point - 253 °C
- Flammability Limits in air 4.1 to 75%

# Physical Properties are Important

## (Continued)

- Minimum Ignition Energy  $2 \times 10^{-5} \text{J}$
- Flame Temperature in air  $2045^{\circ}\text{C}$
- Flame Visibility in Sunlight None
- Odor, Color, Taste None

# What Triggers Safety Concerns with Hydrogen?

- High Pressure
- Extremely Cold Temperature
- Fire/Explosion
- Detectability



# What's a Poor Firefighter to do?

- Insure that hydrogen systems are built to the most recent codes.
- Insist that the hydrogen systems in the community are fail-safe.
- Know how to use a hydrogen detector.
- Know where to cut.
- When all else fails; protect exposures.

# Hydrogen Safety; Basis in Fire Code

- Standard for Gaseous Hydrogen systems at Consumer Sites NFPA 50A 1999 Edition
- Standard for Liquefied Hydrogen systems at Consumer Sites NFPA 50B 1999 Edition
- Compressed Natural Gas (CNG) Vehicular Fuel Systems Code NFPA 52 2002 Edition
- Vehicular Fuel Systems Code NFPA 52 2002 Edition and 2005(Draft)

# Hydrogen Safety Basis in Fire Code (continued)

- Standard for Storage, Use, Handling of Compressed Gases and Cryogenic Fluids in Portable and Stationary Containers, Cylinders and Tanks NFPA 55 2003 and 2005 (Draft)
- Liquefied Natural Gas (LNG) Vehicular Systems Code NFPA 57 2001 Edition



# Hydrogen Safety Basis in Fire Code (continued)

- Motor Vehicle Fuel-dispensing Stations  
Article 52 2001 CFC
- Compressed Gases Article 74 2001 CFC
- Cryogenic Fluids Article 75 2001 CFC
- Hazardous Materials Article 80 2001 CFC



# Sources of Safety Information

- NASA Glenn Research Center, Glenn Safety Manual – Chapter 6 “Hydrogen”
- Idaho National Engineering and Environmental Laboratory Report “Safety Issues with Hydrogen as a Vehicle Fuel”